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ABSTRACT

This report summarizes the most recent (December 1998) long-range statewide forecast of fall enrollment and average annual weekly student contact hours (WSCH) in California Community Colleges. The annual fall survey of college registrars shows that fall 1998 enrollment is up 1.8 percent over fall 1997. The office forecasting model projects an increase of 2.9 percent in fall 1999 enrollment statewide to 1,517,087, which would exceed the colleges' peak recorded in 1991. Further increases are forecast through the year 2005, pushing fall enrollments up by a total of 281,000 students, an increase of nearly 20 percent over this fall. The method used in this report is an econometric regression model to forecast fall enrollment. The structure and function of the model are explained in the attached Appendices A and B. Assumptions that drive future values for the model's five independent variables are student prices, financing, budget outlays, unemployment, and adult population. Recent increases in average student academic load -- largely the result of increasing high school graduate enrollment -- are projected to continue into 1999-2000, followed by use of a three-year moving average throughout the balance of the forecast period. These values are then used to derive total future WSCH. (VWC)

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ED 435 416

Long-Range Statewide Enrollment and WSCH Forecast California Community Colleges

December 1998

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CHANCELLOR'S OFFICE

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December 15, 1998 R&A Memo 98-21

To: Tom Nussbaum, Chancellor
Judy Walters, Vice Chancellor for Policy Development and MIS

From: Chuck McIntyre
Director of Research

Subject: **LONG-RANGE STATEWIDE ENROLLMENT AND WSCH FORECAST, DECEMBER 1998**

Enclosed is a summary and background on our most recent (December 1998) long-range statewide forecast of fall enrollment and average annual weekly student contact hours (WSCH) in California Community Colleges.

Results

Our annual fall survey of college registrars shows that Fall 1998 enrollment is up 1.8 percent over Fall 1997. From that level, the Office forecasting model projects

- *an increase of 2.9 percent in Fall 1999 enrollment statewide*

to 1,517,087, which would exceed the colleges' peak recorded in 1991 (page 3).

Further increases are forecast through the year *2005*, pushing fall enrollments up by a total of *281,000 students, an increase of nearly 20 percent over this fall*; an increase in participation rate from 61 students per 1,000 state adult population up to 64 per 1,000. (Note: This level is well below the rate of at least 73/1000 sought by the *2005 Task Force* and by the *Board of Governor's Strategic Response*. This is largely because our budget assumptions, explained below, do not include the 4 percent annual funding for growth recommended through 2005 in those policy recommendations. Without that funding, there will not be enough college "spaces" to meet a continuing, high demand.)

Our current forecast is only slightly higher than the Department of Finance's (DOF) latest projections:

	Chancellor's Office	*DOF*
Increased enrollment from Fall 1998 to Fall 1999:	2.9%	2.7%
Projected headcount enrollment by 2005	1,756,250	1,737,316

Method

We use an econometric regression model to forecast fall enrollment. The structure and function of the model are explained in the attached Appendices A and B.

Assumptions which drive future values for the model's five independent variables are:

- *Student prices*: the enrollment fee decreases from $13 to $12 per unit in Fall 1998, then - along with other components of the student's price (transportation, child-care, books and supplies) - rises at the rate of the California CPI.

- *Financing:* current financing formulas with the apportionment growth cap continue.

- *Budget outlays:* follow from experience with Proposition 98 (1988), and from a cycling California economy: slowing by 1999, rising in 2003, slowing again in 2007; each downturn, however, is expected to be less severe than the 1991-94 recession.

- *Unemployment*: after declining in 1998, is assumed to be unchanged into 1999, as the recovery slows, and to rise and cycle beginning in 2000.

- *Adult population* continues to increase as forecast by DOF.

Recent increases in average student academic load (average annual WSCH per Fall headcount enrollment) - largely the result of increasing high school graduate enrollment - are projected to continue into 1999-2000, followed by use of a three-year moving average throughout the balance of the forecast period. These values are then used to derive total future WSCH.

If you have any questions or comments, please contact me at (916) 327-5887 or cmcintyr@cc1.cccco.edu or contact Chuen-Rong Chan, Research Specialist, at (916) 327-5886 or cchan@cc1.cccco.edu.

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Appendix A

Results of Chancellor's Office Forecast Model

California Community College Long Range Statewide Enrollment

Forecast, December 1998

1. Model Numbers
2. Model Statistics
3. Model Estimate and Forecast of Fall Enrollment (graph)
4. Participation Rates and Model Residuals (graph)
5. WSCH Forecast
6. WSCH and WSCH/Enrollment (graph)
7. Values of Model's Independent Variables
8. Independent Variables: Ratio to 1970 (graph)

California Community Colleges
Long Range Statewide Enrollment and WSCH Forecast

Model Numbers

	Enroll. Actual	Adults	Student Price	District Budget	Cap	Unemploy	Enrollment Estimated	Enrollment Forecast	Rate %chg.	e Resid'l	%e
1970	825154	13491	1328	2034987	0	558227	888141			62987	7.6%
1971	837350	13740	1328	2069361	0	751759	943906		1.5%	106556	12.7%
1972	921900	13986	1328	2120081	0	656000	958551		10.1%	36651	4.0%
1973	1010900	14295	1328	2146667	0	624000	975906		9.7%	-34994	-3.5%
1974	1137700	14642	1328	2296726	0	679000	1061221		12.5%	-76479	-6.7%
1975	1287400	15040	1328	2469522	0	941000	1192309		13.2%	-95091	-7.4%
1976	1257800	15466	1328	2623883	0	906000	1267454		-2.3%	9654	0.8%
1977	1321800	15899	1328	2713504	0	853000	1312516		5.1%	-9284	-0.7%
1978	1159800	16395	1314	2753710	1	775000	1206342		-12.3%	46542	4.0%
1979	1248500	16850	1257	2765492	1	702000	1297433		7.6%	48933	3.9%
1980	1383300	17361	1240	2667040	1	790000	1314343		10.8%	-68957	-5.0%
1981	1430800	17716	1198	2616217	1	875000	1379226		3.4%	-51574	-3.6%
1982	1354900	18101	1232	2452790	1	1210000	1331020		-5.3%	-23880	-1.8%
1983	1239381	18499	1242	2316393	1	1187000	1269977		-8.5%	30596	2.5%
1984	1144300	18864	1328	2402970	1	980000	1162854		-7.7%	18554	1.6%
1985	1175500	19304	1323	2354672	1	934000	1158148		2.7%	-17352	-1.5%
1986	1225400	19784	1315	2426043	1	890000	1209939		4.2%	-15461	-1.3%
1987	1264409	20305	1300	2437170	1	791000	1239082		3.2%	-25327	-2.0%
1988	1336275	20856	1299	2532892	1	748000	1294134		5.7%	-42141	-3.2%
1989	1407430	21472	1285	2732715	1	737000	1420204		5.3%	12774	0.9%
1990	1505381	22086	1298	2875082	1	874000	1507351		7.0%	1970	0.1%
1991	1515261	22476	1306	2861851	1	1172000	1554014		0.7%	38753	2.6%
1992	1500393	22838	1316	2844065	1	1431000	1587595		-1.0%	87202	5.8%
1993	1376565	22987	1467	2787461	1	1441000	1353903		-8.3%	-22662	-1.6%
1994	1358687	23088	1463	2701311	1	1328000	1308197		-1.3%	-50490	-3.7%
1995	1336406	23210	1456	2753029	1	1209000	1325044		-1.6%	-11362	-0.9%
1996	1407335	23371	1432	2866059	1	1124000	1399136		5.3%	-8199	-0.6%
1997	1449304	23773	1422	2980701	1	1005000	1456723		3.0%	7419	0.5%
1998	1475000	24201	1409	3070122	1	942000	1519662		1.8%	44662	3.0%
1999		24639	1409	3131525	1	942000		1517087	2.9%		
2000		25073	1409	3194155	1	1012650		1571264	3.6%		
2001		25533	1409	3226097	1	1164548		1626887	3.5%		
2002		25998	1409	3226097	1	1281002		1663346	2.2%		
2003		26492	1409	3258358	1	1216952		1684581	1.3%		
2004		27033	1409	3323525	1	1095257		1711906	1.6%	Change	
2005		27584	1409	3423230	1	985731		1756250	2.6%	281250	19.4%
2006		28146	1409	3525927	1	985731		1820370	3.7%		
2007		28704	1409	3596446	1	1084304		1887052	3.7%		
2008		29267	1409	3632410	1	1246950		1949975	3.3%		
2009		29844	1409	3632410	1	1371645		1991907	2.2%		
2010		30432	1409	3668734	1	1303063		2017599	1.3%	542599	37.4%
2011		31032	1409	3742109	1	1237910		2059911	2.1%		
2012		31643	1409	3854372	1	1176014		2119651	2.9%		
2013		32266	1409	3970004	1	1176014		2191507	3.4%		
2014		32902	1409	4049404	1	1234815		2258241	3.0%		
2015		33550	1409	4089898	1	1358296		2319714	2.7%	844714	58.3%

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Source: Chancellor's Office, Research and Analysis Unit, 12/14/98.

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Long Range Statewide Enrollment and WSCH Forecast

SUMMARY OUTPUT — **Model Statistics**

Regression Statistics	
Multiple R	0.96692
R Square	0.93494
Adjusted F	0.92079
Standard I	52884.4
Observatic	29

ANOVA

	df	*SS*	*MS*	*F*	*ignificance F*
Regressio	5	9.2E+11	1.85E+11	66.1	7.04E-13
Residual	23	6.4E+10	2.8E+09		
Total	28	9.9E+11			

	Coefficient	*tandard Er*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*wer 95.0%*	*per 95.0%*
Intercept	1343994	252731	5.317876	2E-05	821180.3	1866809	821180	2E+06
Adults	36.8846	8.34006	4.42258	2E-04	19.63189	54.1373	19.6319	54.137
Price	-1435.1	225.061	-6.37637	2E-06	-1900.64	-969.5	-1900.6	-969.5
Budget	0.42257	0.05559	7.601828	1E-07	0.307576	0.53756	0.30758	0.5376
Cap	-148917	47883.7	-3.10998	0.005	-247972	-49863	-247972	-49863
Unemploy	0.16564	0.05673	2.919954	0.008	0.04829	0.28298	0.04829	0.283

Durbin Watson Statistic = 1.190 Signif. = +no -no

	t	P	Elasticity	Average
Enroll.				1462152
Adults	4.42	0.000	0.47	18,782
Price	-6.38	0.000	-1.30	1326
Budget	7.60	0.000	0.74	2557228
Cap	-3.11	0.005	-0.07	0.71
Unemploy	2.92	0.008	0.11	934714

Adj.R2 = 0.921
F Ratio = 66.1

Ave. % Off = 3.2%

Correlations:	*Enroll*	*Adults*	*Price*	*Budget*	*Cap*	*Unemploy*
Enroll	1.000					
Adults	0.779	1.000				
Price	0.077	0.470	1.000			
Budget	0.879	0.761	0.307	1.000		
Cap	0.659	0.786	0.004	0.597	1.000	
Unemploy	0.580	0.665	0.406	0.481	0.497	1.000

Source: Chancellor's Office, Research and Analysis Unit, 12/14/98.

California Community Colleges
Long Range Statewide Enrollment and WSCH Forecast

Enrollment and Participation Rate

	Actual				Forecast				
	Enrollment	% Chg.	Popul'n/ 1000	E/1000P Actual	Population/ 1000	Enrollment	% Chg.	E/1000P Forecast
1970	825154		13491	61.2				
1971	837350	1.5%	13740	60.9				
1972	921900	10.1%	13986	65.9				
1973	1010900	9.7%	14295	70.7				
1974	1137700	12.5%	14642	77.7				
1975	1287400	13.2%	15040	85.6				
1976	1257800	-2.3%	15466	81.3				
1977	1321800	5.1%	15899	83.1				
1978	1159800	-12.3%	16395	70.7				
1979	1248500	7.6%	16850	74.1				
1980	1383300	10.8%	17361	79.7				
1981	1430800	3.4%	17716	80.8				
1982	1354900	-5.3%	18101	74.9				
1983	1239381	-8.5%	18499	67.0				
1984	1144300	-7.7%	18864	60.7				
1985	1175500	2.7%	19304	60.9				
1986	1225400	4.2%	19784	61.9				
1987	1264409	3.2%	20305	62.3				
1988	1336275	5.7%	20856	64.1				
1989	1407430	5.3%	21472	65.5				
1990	1505381	7.0%	22086	68.2				
1991	1515261	0.7%	22476	67.4				
1992	1500393	-1.0%	22838	65.7				
1993	1376565	-8.3%	22987	59.9				
1994	1358687	-1.3%	23088	58.8				
1995	1336406	-1.6%	23210	57.6				
1996	1407335	5.3%	23371	60.2				
1997	1449304	3.0%	23773	61.0				
1998	1475000	1.8%	24201	60.9				
1999					24639	1517087	2.9%	61.6
2000					25073	1571264	3.6%	62.7
2001					25533	1626887	3.5%	63.7
2002					25998	1663346	2.2%	64.0
2003					26492	1684581	1.3%	63.6
2004					27033	1711906	1.6%	63.3
2005					27584	1756250	2.6%	63.7
2006					28146	1820370	3.7%	64.7
2007					28704	1887052	3.7%	65.7
2008					29267	1949975	3.3%	66.6
2009					29844	1991907	2.2%	66.7
2010					30432	2017599	1.3%	66.3
2011					31032	2059911	2.1%	66.4
2012					31643	2119651	2.9%	67.0
2013					32266	2191507	3.4%	67.9
2014					32902	2258241	3.0%	68.6
2015					33550	2319714	2.7%	69.1

Source: Chancellor's Office, Research and Analysis Unit, 12/14/98.

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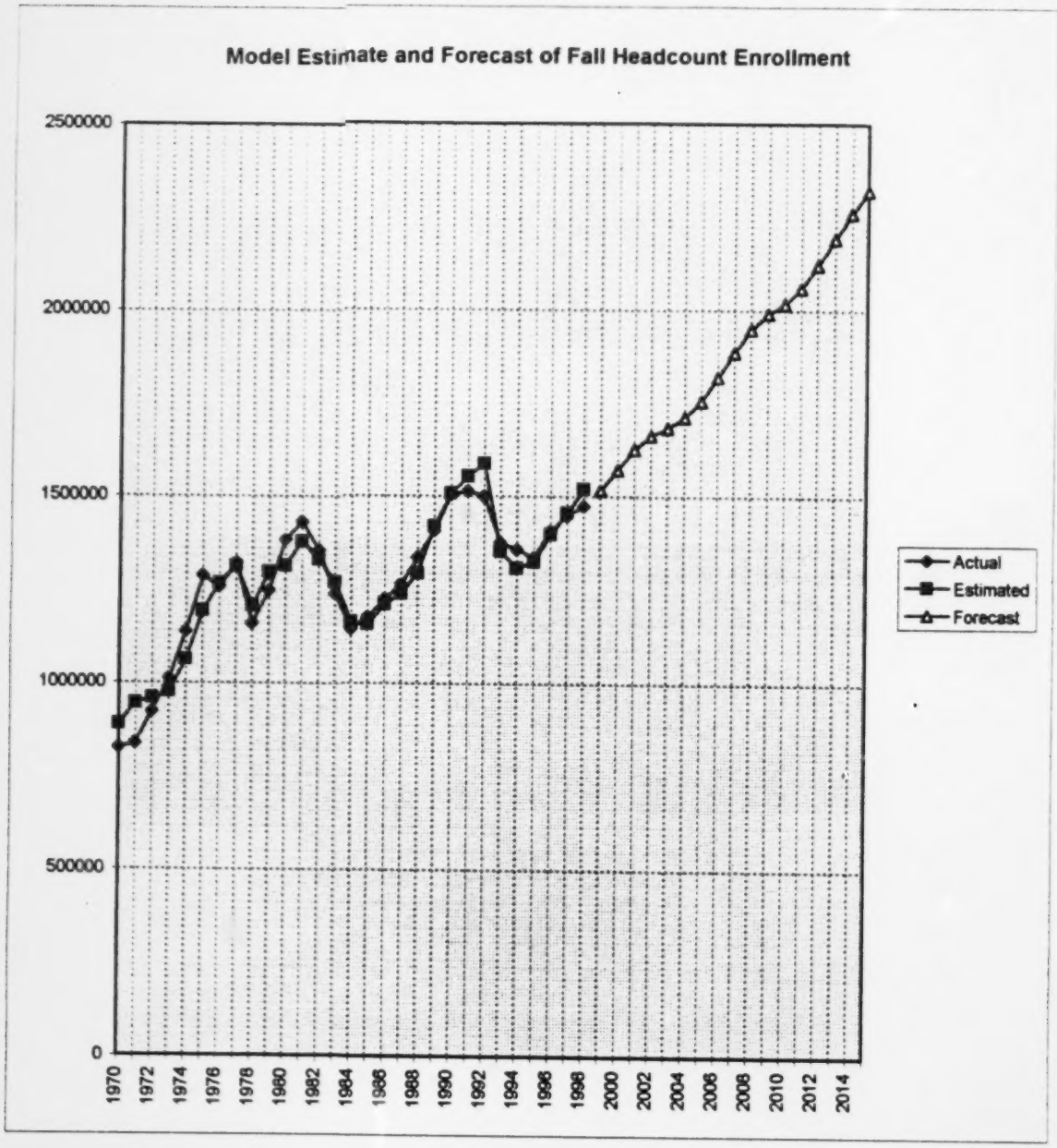
Long Range Statewide Enrollment and WSCH Forecast



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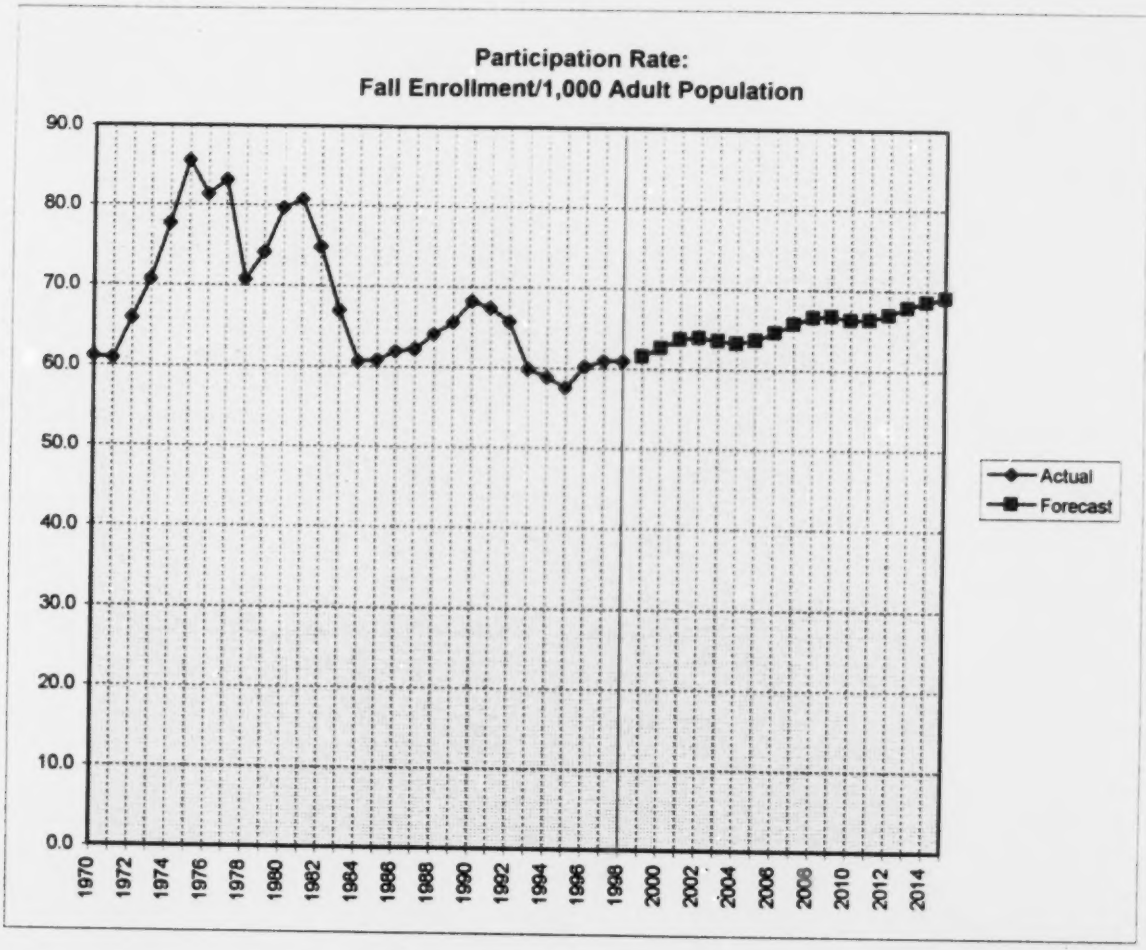

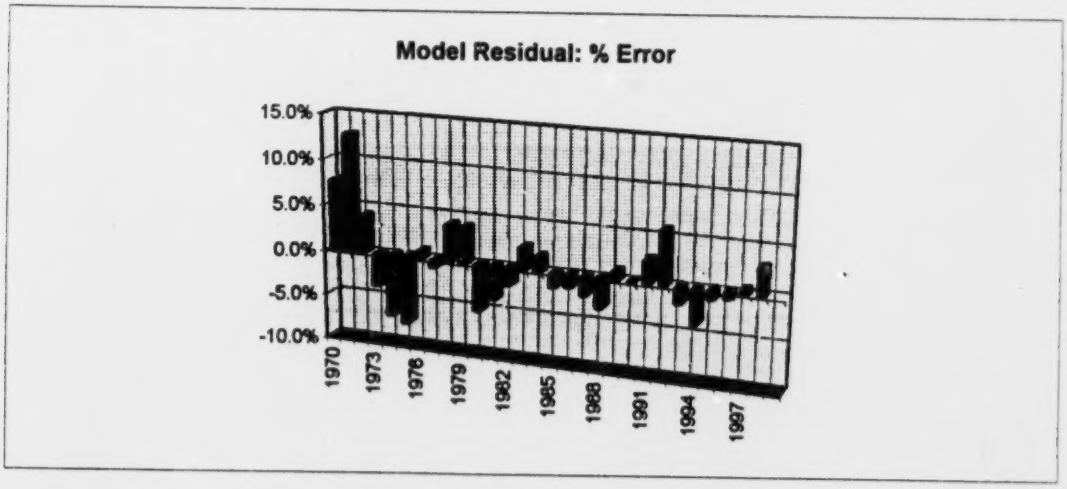

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California Community Colleges
Long Range Statewide Enrollment and WSCH Forecast

WSCH Forecast

	Enrollment	WSCH		WSCH/Enrollment		Enrollment	WSCH	
	Actual	Actual	% Chg.	Actual	Forecast	Forecast	Forecast	% Chg.
1970								
1971								
1972								
1973	1010900							
1974	1137700	11471235		10.08				
1975	1287400	12437516	8.4%	9.66				
1976	1257800	10675805	-14.2%	8.49				
1977	1321800	11764613	10.2%	8.90				
1978	1159800	10741091	-8.7%	9.26				
1979	1248500	11193259	4.2%	8.97				
1980	1383300	11979086	7.0%	8.66				
1981	1430800	12265547	2.4%	8.57				
1982	1354900	12050150	-1.8%	8.89				
1983	1239381	10886592	-9.7%	8.78				
1984	1144300	10315427	-5.2%	9.01				
1985	1175500	10259029	-0.5%	8.73				
1986	1225400	10586311	3.2%	8.64				
1987	1264409	10885462	2.8%	8.61				
1988	1336275	11419806	4.9%	8.55				
1989	1407430	12050009	5.5%	8.56				
1990	1505381	12641806	4.9%	8.40				
1991	1515261	13031434	3.1%	8.60				
1992	1500393	12812432	-1.7%	8.54				
1993	1376565	12364674	-3.5%	8.98				
1994	1358687	12198234	-1.3%	8.98				
1995	1336406	12184626	-0.1%	9.12				
1996	1407335	12661173	3.9%	9.00				
1997	1449304	12950941	2.3%	8.94				
1998	1475000	13339469	3.0%	9.04				
1999					9.12	1517087	13829850	3.7%
2000					9.03	1571264	14191523	2.6%
2001					9.06	1626887	14745925	3.9%
2002					9.07	1663346	15087581	2.3%
2003					9.06	1684581	15254679	1.1%
2004					9.06	1711906	15515567	1.7%
2005					9.06	1756250	15917139	2.6%
2006					9.06	1820370	16493735	3.6%
2007					9.06	1887052	17101168	3.7%
2008					9.06	1949975	17670783	3.3%
2009					9.06	1991907	18050053	2.1%
2010					9.06	2017599	18283564	1.3%
2011					9.06	2059911	18666766	2.1%
2012					9.06	2119651	19208035	2.9%
2013					9.06	2191507	19859335	3.4%
2014					9.06	2258241	20464008	3.0%
2015					9.06	2319714	21021068	2.7%

Source: Chancellor's Office, Research and Analysis Unit, 12/14/98.

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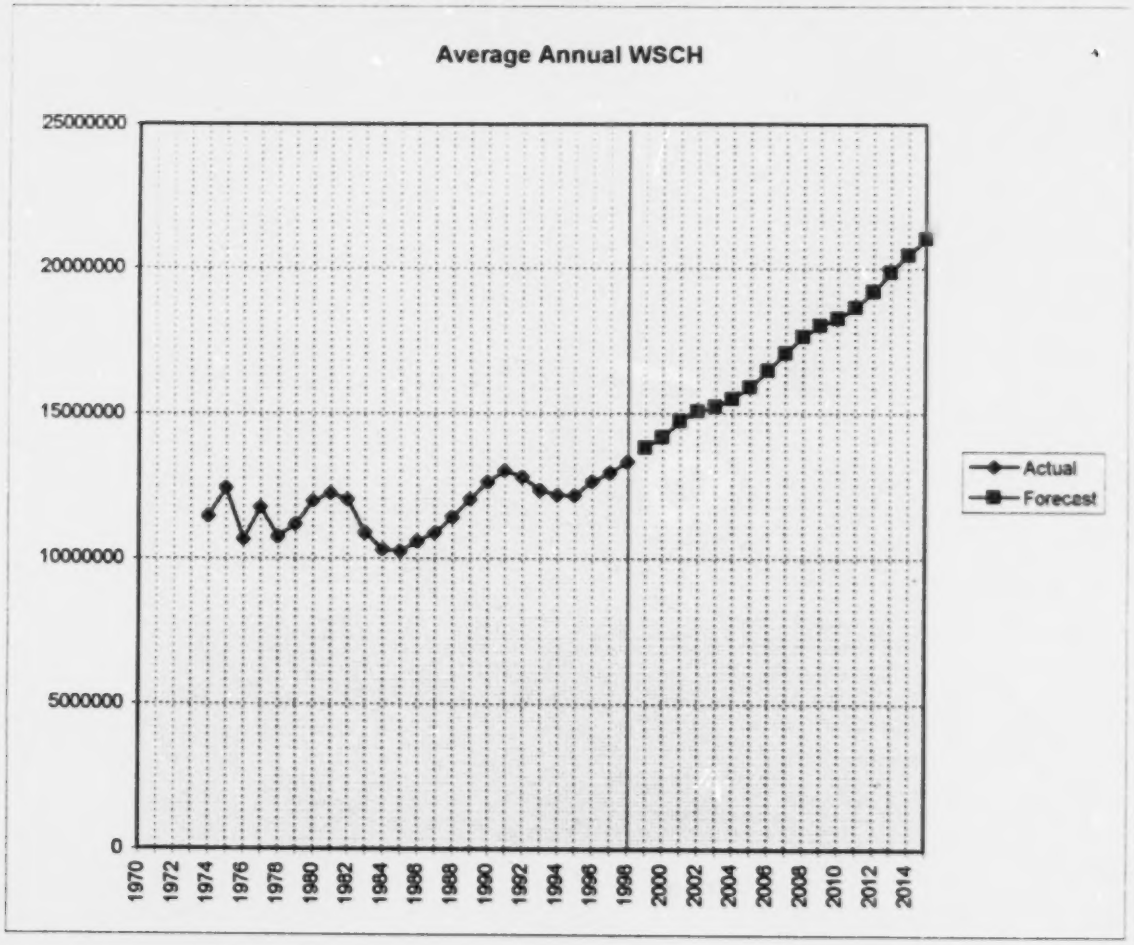

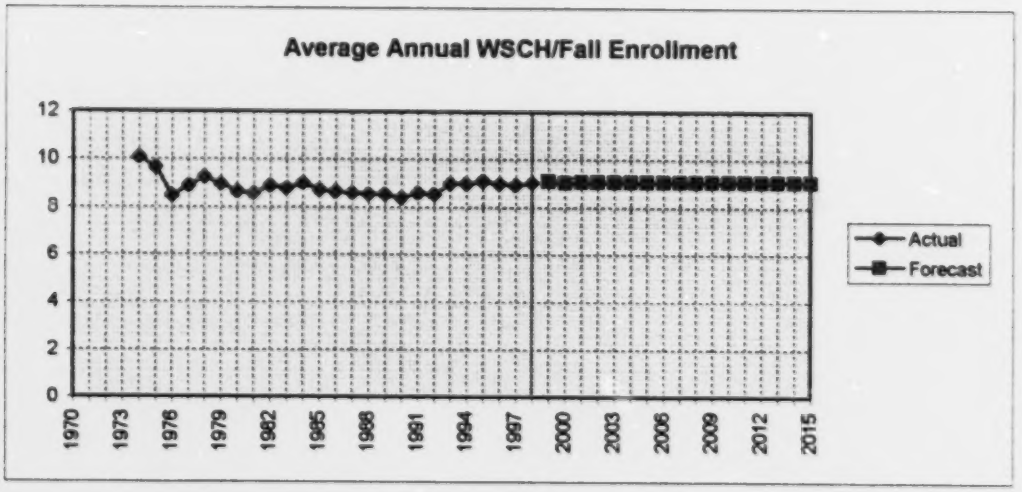

Source: Chancellor's Office, Research and Analysis Unit, 12/14/98.

California Community Colleges
Long Range Statewide Enrollment and WSCH Forecast

Values (Actual and Projected) of Model's Independent Variables

	WSCH	Enroll.	Popul'n.	Nominal Budget	Inemploy Number	Real Budget	Budget % Chg.	Popul'n. % Chg.	Real Price	% Chg.	Unemp % Chg
1970		825154	13490796	486047	558227	2034987			1328		
1971		837350	13739781	528656	751759	2069361	1.7%	1.8%	1328	0.0%	34.7%
1972	9341797	921900	13985774	575000	656000	2120081	2.5%	1.8%	1328	0.0%	-12.7%
1973	10139125	1010900	14295418	625407	624000	2146667	1.3%	2.2%	1328	0.0%	-4.9%
1974	11471235	1137700	14642320	743472	679000	2296726	7.0%	2.4%	1328	0.0%	8.8%
1975	12437516	1287400	15040154	881509	941000	2469522	7.5%	2.7%	1328	0.0%	38.6%
1976	10675805	1257800	15466183	996295	906000	2623883	6.3%	2.8%	1328	0.0%	-3.7%
1977	11764613	1321800	15899143	1096797	853000	2713504	3.4%	2.8%	1328	0.0%	-5.8%
1978	10741091	1159800	16395453	1185324	775000	2753710	1.5%	3.1%	1314	-1.1%	-9.1%
1979	11193259	1248500	16849804	1299273	702000	2765492	0.4%	2.8%	1257	-4.3%	-9.4%
1980	11979086	1383300	17360925	1393021	790000	2667040	-3.6%	3.0%	1240	-1.4%	12.5%
1981	12265547	1430800	17715732	1501521	875000	2616217	-1.9%	2.0%	1198	-3.3%	10.8%
1982	12050150	1354900	18100819	1500000	1210000	2452790	-6.2%	2.2%	1232	2.8%	38.3%
1983	10886592	1239381	18499074	1481438	1187000	2316393	-5.6%	2.2%	1242	0.8%	-1.9%
1984	10315427	1144300	18864354	1606185	980000	2402970	3.7%	2.0%	1328	6.9%	-17.4%
1985	10259029	1175500	19303782	1637764	934000	2354672	-2.0%	2.3%	1323	-0.4%	-4.7%
1986	10586311	1225400	19784321	1736223	890000	2426043	3.0%	2.5%	1315	-0.6%	-4.7%
1987	10885462	1264409	20304568	1812419	791000	2437170	0.5%	2.6%	1300	-1.1%	-11.1%
1988	11419806	1336275	20855871	1939003	748000	2532892	3.9%	2.7%	1299	-0.1%	-5.4%
1989	12050009	1407430	21472238	2163698	737000	2732715	7.9%	3.0%	1285	-1.1%	-1.5%
1990	12641806	1505381	22085596	2387098	874000	2875082	5.2%	2.9%	1298	1.0%	18.6%
1991	13031434	1515261	22476371	2451227	1172000	2861851	-0.5%	1.8%	1306	0.6%	34.1%
1992	12812432	1500393	22838297	2488246	1431000	2844065	-0.6%	1.6%	1316	0.8%	22.1%
1993	12364674	1376565	22986716	2499692	1441000	2787461	-2.0%	0.6%	1467	11.5%	0.7%
1994	12198234	1358687	23087986	2476793	1328000	2701311	-3.1%	0.4%	1463	-0.3%	-7.8%
1995	12184626	1336406	23209752	2606104	1209000	2753029	1.9%	0.5%	1456	-0.5%	-9.0%
1996	12661173	1407335	23371191	2800864	1124000	2866059	4.1%	0.7%	1432	-1.6%	-7.0%
1997		1449304	23773145		1005000	2980701	4.0%	1.7%	1422	-0.7%	-10.6%
1998		1475000	24201071		942000	3070122	3.0%	2.21%	1409	-1.0%	-6.3%
1999			24638654		942000	3131525	2.0%	1.96%	1409	0.0%	0.0%
2000			25072707		1012650	3194155	2.0%	1.93%	1409	0.0%	7.5%
2001			25532657		1164548	3226097	1.0%	2.02%	1409	0.0%	15.0%
2002			25998174		1281002	3226097	0.0%	1.97%	1409	0.0%	10.0%
2003			26491911		1216952	3258358	1.0%	1.98%	1409	0.0%	-5.0%
2004			27032641		1095257	3323525	2.0%	1.99%	1409	0.0%	-10.0%
2005			27584432		985731	3423230	3.0%	1.94%	1409	0.0%	-10.0%
2006			28146297		985731	3525927	3.0%	1.97%	1409	0.0%	0.0%
2007			28703594		1084304	3596446	2.0%	1.98%	1409	0.0%	10.0%
2008			29267141		1246950	3632410	1.0%	1.96%	1409	0.0%	15.0%
2009			29844029		1371645	3632410	0.0%	1.97%	1409	0.0%	10.0%
2010			30432398		1303063	3668734	1.0%	1.97%	1409	0.0%	-5.0%
2011			31031503		1237910	3742109	2.0%	1.97%	1409	0.0%	-5.0%
2012			31642952		1176014	3854372	3.0%	1.97%	1409	0.0%	-5.0%
2013			32266374		1176014	3970004	3.0%	1.97%	1409	0.0%	0.0%
2014			32901939		1234815	4049404	2.0%	1.97%	1409	0.0%	5.0%
2015			33550144		1358296	4089898	1.0%	1.97%	1409	0.0%	10.0%

Source: Chancellor's Office, Research and Analysis Unit, 12/14/98.

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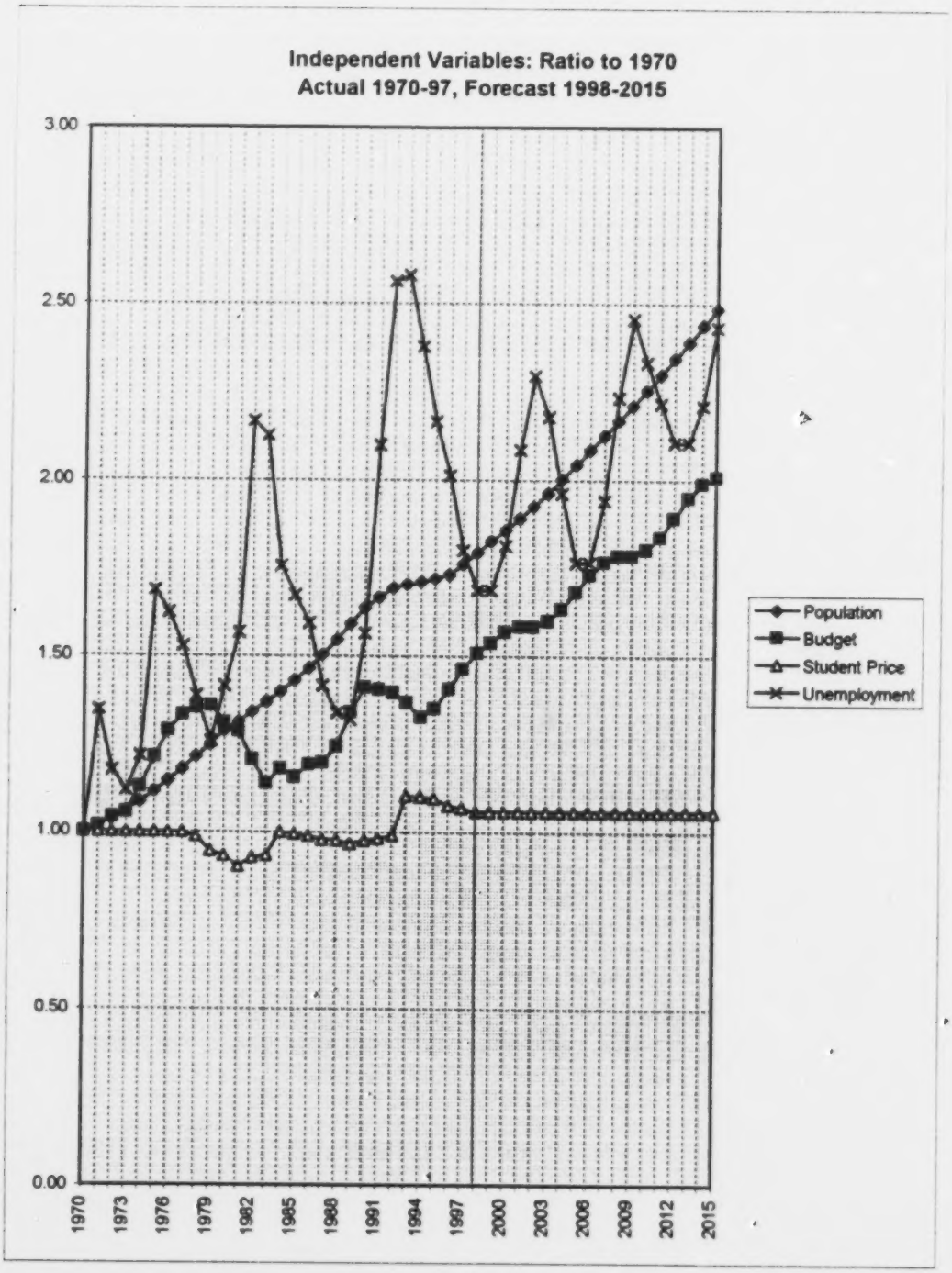
California Community Colleges
Long Range Statewide Enrollment and WSCH Forecast



Source: Chancellor's Office, Research and Analysis Unit, 12/14/98.

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Appendix B

Use of Econometric Regression Model to Forecast Enrollment

The Chancellor's Office enrollment forecasting activity uses an econometric model to analyze community college data and measure parameters that help explain and predict enrollment:

$$E = a + b_1T + b_2P + b_3UN + b_4B + b_5F + e$$

where,

E = Student fall headcount enrollment

T = Student "out-of-pocket" price of enrollment: tuition, fees, transportation, child care, and books and supplies (price-adjusted)

P = Adult population

UN = Unemployment

B = Colleges' operating budgets (price-adjusted)

F = Colleges' financing mechanism

and, $a, b_1 \ldots b_5$ = regression parameters

e = model estimate errors or "residuals"

The first step is to "fit" this model to historic data so as to "estimate" past enrollment patterns. Time series analyses like this typically have a high "fit" since most variables are increasing over time. Consequently, we pay close attention to the model's errors or residuals. For this, the

- *Durban-Watson (DW) statistic:* helps explain enrollment trends that result from factors not in our model by measuring the pattern of model errors or "residuals." The closer DW is to the value 2, the less likely we are to have left out important factors.

Residuals may also be compared to actual enrollment to measure the relative *percent error* in the estimate for any given year(s).

Besides the model's overall fit, we assess the relative impact on enrollment, our dependent variable, of the different factors or independent variables. In this case, two measures are especially useful:

- *elasticity (e):* the percent change in, say, enrollment that results from a one percent change in an independent variable (such as fees, or unemployment), when the impact on enrollment of other variables in the model is held constant

- *t-value (t):* indicates the significance or statistical "fit" of each variable - how well each is related - to enrollment. The t value enables us to say, for instance, at a standard 95% confidence level, that the probability (P) < .01 means there is less than one chance in 100 that our results are due to purely random events.

Regression models may have certain inherent problems or *model errors*. Independent variables may be highly interrelated, relationships may not be linear, important variables may be missing, or the direction of causation sometimes isn't clear. Valid study must identify and correct such problems as they occur.

Also contributing to potential errors are data problems or *measurement errors*. Some data may not be measuring what we think they are, are measured incorrectly, or are missing. There is no one simple rule to correct for such problems; they must be addressed as they are encountered.

Once the form of the model has been validated, it is easily modified to produce forecasts.

The work described here is performed in a modified Excel spreadsheet utility. A major advantage to this is that once it is modified to add the necessary statistics and formats, the spreadsheet, in contrast to some other statistical utilities like SAS or SPSS, provides easy access to powerful and attractive graphics for effective presentation.